- The additionally possible allocation of the same service combinations to various common channels using a respective unique TFCI value permits a very high degree of flexibility to be achieved.
- The complexity for signaling common channels can be matched very precisely to the requirements of the connection and need not involve whole bits.
- The use of common channels can be limited to particular, higher-rate service combinations or those with high data rate dynamics, while low-rate service combinations are transmitted exclusively using dedicated channels.
- It is possible to allocate common channels on a connection-oriented basis and dynamically, depending on the current number of used channels.

Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Preferred Embodiments and the Drawings.

DESCRIPTION OF THE DRAWINGS

Figure 1 shows a schematic illustration of a radio communication system;

Figure 2 shows a layer model of the transmission protocols;

Figures 3, 4 show data for various services mapped onto jointly used physical channels;

Figures 5, 6 show tables containing allocation options for common channels for a number of connections;

Figures 7, 8 show ambiguous allocations and, hence, reduction in the likelihood of blockages; and

Figure 9 shows data transmission in frames with in-band signaling.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The mobile radio system shown in Figure 1 as an example of a radio communication system includes a multiplicity of mobile switching centers MSC which are interlinked and set up access to a landline network PSTN. In addition, these mobile switching centers MSC are connected to at least one respective device

RNM for controlling the transmission resources. Each of these devices RNM permits, in turn, a connection to at least one base station BS.

A base station BS can set up a connection to subscriber stations, e.g. mobile stations MS or other mobile and stationary terminals, via a radio interface. Each base station BS forms at least one radio cell. Figure 1 shows connections for transmitting user information between a base station BS and mobile stations MS. Within a connection V1, data for, by way of example, three services S (S1, S2, S3) are transmitted within one or more physical channels Phy CH, and signaling information, e.g. the allocated radio system resources for a connection V1, is transmitted via a monitoring channel FACH (Forward link Access CHannel) which accompanies the connection.

An operation and maintenance center OMC provides monitoring and maintenance functions for the mobile radio system or for parts thereof. The functional scope of this structure can be transferred to other radio communication systems in which the present invention can be used, in particular for subscriber access networks with wireless subscriber access.

In the radio communication system shown in Figure 1, both the base stations BS and the mobile stations MS are provided with both transmission and signaling devices which communicate with one another. The transmission device is used for transmitting data for a combination of a number of services S via the currently available physical channels Phy CH. The physical channels Phy CH may be in the form of dedicated channels DCH, i.e. used exclusively by one connection, or in the form of common channels DSCH, i.e. used alternately by different connections V1, V2. A distinction, therefore, needs to be drawn between physical channels Phy CH jointly used by a number of services S1, S2, S3 on a connection V1 and common channels DSCH, which are allocated to a number of connections V1, V2 but is allocated to just one of the connections V1 or V2 for use during a period of time. The allocation of a common channel DSCH can be changed very rapidly from frame to frame without additional signaling complexity. The use of a common channel DSCH by different connections at successive times permits, in particular, good

correspondence to the high data rate and high dynamics of the data rate of some connections V1, V2.

The signaling device determines TFCI values for the selected combinations of transport formats TF for the services S1, S2, S3 and performs in-band signaling of the transport formats TF. In the separate channel FACH, the mapping specification for TFCI value to combination of transport formats TF and used channels DCH, DSCH is signaled.

a1 cont'

The layer model shown in Figure 2 shows the protocols of the radio communication system divided into three layers.

<u>Layer 1</u>: physical layer for describing all the functions for bit transmission via a physical medium (e.g., coding, modulation, transmission power monitoring, synchronization etc.).

<u>Layer 2</u>: data link layer for describing the mapping of data onto the physical layer, and monitoring thereof.

<u>Layer 3</u>: network layer for controlling the resources of the radio interface.

Layer 3 stipulates the TFCS for a connection, while layer 2 selects a combination (of a TFC) which is signaled in-band using a TFCI, as shown later.

The parameter exchange between layers 1 and 2 supports the functions of transferring frames with data for layer 2 via the radio interface and of displaying the status of layer 1 to higher layers. The parameter exchange between layers 1 and 3 supports monitoring of the configuration of the transmission in layer 1 and generates system information relating to layer 1.

In this case, the mapping of the data for various connections S onto a common physical channel Phy CH and the signaling of the allocation of a common channel DSCH correspond to the interaction of layers 1 and 2.

Figures 3 and 4 show the need for transport formats TF to be signaled for currently transmitted services.

Figure 3 shows, as an illustration of function, a coding and multiplex unit which maps data from a number of data channels DCH (which each correspond to the data for a service S1, S2, S3) onto a coded common transport channel CCTrCH.

In this context, mapping is a specification governing the bit pattern which is to be used for entering the data into a serial data sequence. A demultiplexer/allocation device distributes the data for the coded common transport channel CCTrCH over a number of physical channels Phy CH. The physical channels Phy CH are, thus, constantly used to transmit data for a number of services S1, S2, S3 in each case. A physical channel Phy CH is not allocated to one service S1 or S2 or S3 alone, but rather is allocated to the coded common transport channel CCTrCH with all its services S1, S2, S3.

a1 cont'

Since the reception end needs to reconstruct this mapping and needs to read the data from the physical channels Phy CH and present them again in separate transport channels DCH for the services, signaling is necessary. This signaling in the form of TFCI values depicts the currently used combination of the transport formats TF for the services and, as shown later, the current allocation of a common channel or of a number of common channels DSCH. It has been agreed at connection setup which combinations are permitted for the connection (TFCS).

Two options in the relationship between data rate and service combinations can be implemented (cf. also EP 98 122 719):

1. Each data rate GR corresponds to precisely one combination of transport formats TF.
2. For each data rate GR, a number of combinations of transport formats TF are possible which can be distinguished using TFCI values.

Figure 4 shows the mapping in a slightly modified form, with it becoming clear that the partial information item TFCI need be signaled only when physical channels Phy CH are jointly used by a number of services S1, S2, S3. If a service S1 or S2 or S3 uses one physical channel Phy CH exclusively, then signaling of the partial information item TFCI can be dispensed with.

The allocation of a common channel DSCH to a connection V is shown with reference to Figures 5 and 6 using an example having two mobile stations MS and, hence, two connections V1, V2. Let it be assumed that the connections 1 and 2 each can transmit their data using the data rates of 16, 32 and 48 kbps, with three

common channels DSCH each having 16 kbps being available for both connections V1, V2. For the two connections V1, V2, the tables shown in Figures 5 and 6 each stipulate which of these common channels DSCH can be used to transmit which data rates. This table has been stipulated at the start of connection, but also may be changed concurrently with the connection.

a1 cont'

Since the two connections V1, V2 exist in parallel, only particular combinations of the data rates are permitted, in order to prevent simultaneous use of the common channels DSCH. These are indicated in the table shown in Figure 7.

In this example, only 10 of 16 possible combinations are permitted. All the combinations in which more than 16 kbps are transmitted simultaneously for the two connections V1, V2 must be excluded.

In general, the described implicit allocation of common channels DSCH allows the available channels to be split over all the connections V1, V2 with such flexibility that each individual connection V1, V2 is able to use a much higher transmission capacity than in the case of fixed allocation of the channels as dedicated channels DCH.

In this case, for statistical reasons, the limitation to particular combinations becomes less significant the more connections V1, V2 and common channels DSCH are available. This assumes that the ratio of the maximum data rate required by all connections V1, V2 to the data rate which is possible as a result of the use of all common channels DSCH remains constant.

An additional degree of freedom is possible if not every data rate has a fixed mapping, i.e. uniquely onto prescribed TFCI values, but instead alternatives can be chosen. For the purposes of illustration, Figure 8 shows, for a connection V1, the incorporation of the configuration of the common channels DSCH into the information signaled by the TFCI values.

A TFCI value represents a particular configuration of the services S1 to S3. To date, only one TFCI value for each permitted combination was appropriate. The extension by the configuration data for the common channels DSCH can now be used to allocate a particular service combination to different combinations of